

Managing the Development of Specialty Fertilizers From Inception to Commercialization

**Presented
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**Presented
for
The Fertilizer Industry Round Table
58th Annual Meeting
Charleston, SC
November 13, 2008**

Five Primary Development Phases

- 1. Conception**
- 2. Product development**
- 3. Process development**
- 4. Plant construction or alteration**
- 5. Production**

Conception

- **Project Inception**
 - **Possible economic opportunity**
 - **Niche Market**
 - **Company challenge/problem**
 - **Competition**

Incubation

- Project merits discussed
- Ideas simmer
- Must be careful not to loose project
 - A promoter or champion for the project

Project Goals

- Estimated market potential
- Desired characteristics
- Estimated production requirements
- Range of acceptable production costs
- Timing requirements
- Budget limitations
- Project priority
- Special considerations

PRODUCT DEVELOPMENT

- Exploratory lab work
- Small scale pilot plant
- Large scale pilot plant

EXPLORATORY LAB WORK

- **Rough Assessment**

- **Experience**
- **Literature**
- **Involve Design Engineers**

Exploratory Lab Work



PROCESS DEVELOPMENT

- In-depth Lab Work
- Review
 - Feasibility
 - Production Cost
 - Involve Design Engineers

Process Development Conceptual Design

- Based on lab work
- Assess feasibility
- Preliminary conceptual design
 - Equipment
 - Preliminary layout
 - Lab methods compatible with full scale plant
 - Review

Evaluate Full Scale Capital And Production Cost

- Reasonable
- Conceptual design
- Cost estimate
- Scale down the full scale plants
- Scale up the lab work

Full Scale Review

- Original goals are still valid
- Goals met by development efforts
- Estimate chance for success

CONCEPTUAL DESIGN COMPLETE

- **Alter Concepts**
 - **Improve product**
 - **Improve production costs**
 - **Avoid processing problems**
 - **Refine product and process in lab**
 - **Involve design engineers**

Concept Investigation

- **Test Specific Areas**
 - **Evaluate potential problems**
 - **Determine potential solutions**

Small Scale Pilot Plant



SMALL SCALE PILOT PLANT

- **Assess Feasibility**
 - **Process experience**
 - **Scale up data**
- **Provide Product**
 - **As soon as product is available, full scale evaluation of properties should start**
- **Design / Build Pilot Plant**
 - **Economic**
 - **Materials of construction**
 - **Pressure**
 - **Safety**
 - **Flexible**
 - **Easy to modify**

Small Scale Pilot Plant



Small Scale Pilot Plant

- Review full scale plant design
- Scale up challenges may be identified
- Revise
- Involve design engineers

Small Scale Pilot Plant



Small Scale Pilot Plant

■ Evaluate Cost

- Large scale pilot plant**
- Full scale plant**
- Production cost**

The project must again go under detailed management review to determine if it should be continued. Before progressing to the full scale pilot plant a high likelihood of project success should be evident!

Large Scale Pilot Plant



Large Scale Pilot Plant



Small Scale Pilot Plant



LARGE SCALE PILOT PLANT

- A small production plant
- Designed and built for change
- Mirror full scale plant
- Test scale up
- Scale up at a ratio of 10:1
- Involve design engineers

Factors Affecting Cost Of Large Scale Pilot Plant

- Capacity
- Life Expectancy Of Pilot Plant
- Used For Production
- Location
- Existing Equipment/Facilities Available
- Experience Of Design/Fabrication Company

Large Scale Pilot Plant

- **Upon Completion**
 - Revise design
 - Size major components
 - Revise full scale plant layout
 - Revise production cost
 - Detailed management review
 - Production feasibility
 - Economics
 - Sales
 - Capital
 - Timing

Market Development

- Use large pilot plant to generate product for market development
- May provide
 - Product for early market introduction
 - Training for operators

Full Scale Plant Construction

- Revised conceptual design/final design
 - Design Engineers
 - Informed as project moves through development
 - Part of solution to challenges/problems

Production Start-up Full Scale Plant

- **Final step of the development process**
- **Final exam**
- **Success of start-up is knowledge of
plant and process**
- **Attention to detail**

Summary

- **Conceive idea for product**
- **Develop product**
- **Develop process**
- **Construct or modify plant**
- **Production**

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Confidentiality

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